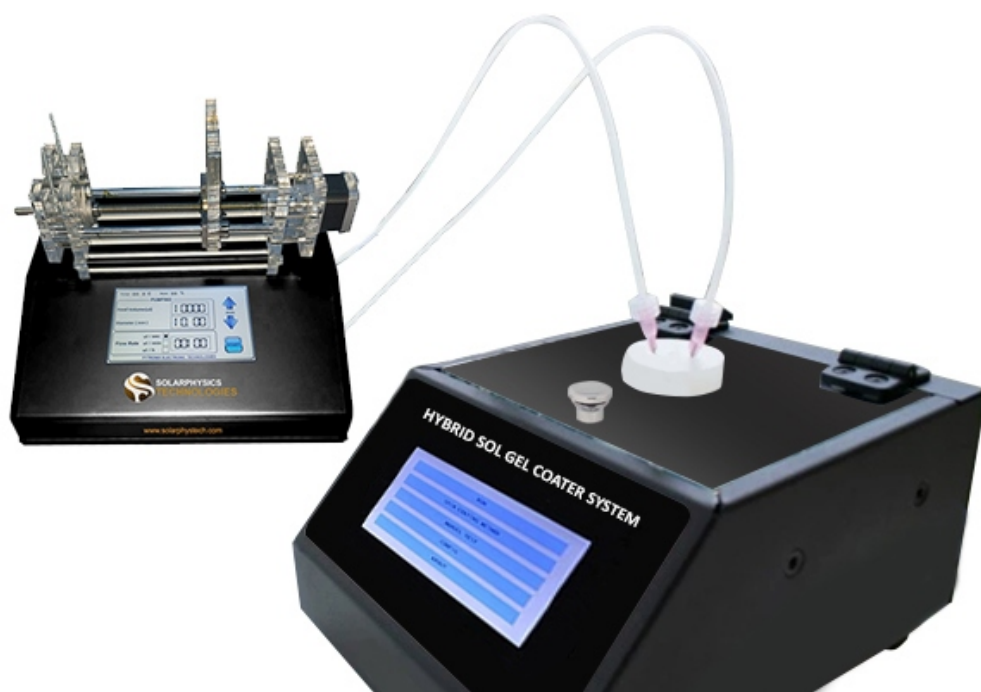




**ESSC**  
TECHNOLOGIES

## **HYBRID SOL GEL SPIN COATER**

**SP-X9**



### **TECHNICAL DATA**

Spin Coater X9

7-inch touch screen

Hybrid sol gels coating method

Syringe pump

Flow rate: microliter/s, microliter/min and microliter/h

• Spin speed: 101-12,000 rpm

Automatic vacuum on-off•

Spin speed acceleration: 0 to 30,000 rpm/s

Spin speed deceleration: 0 to 30,000 rpm/s

- Touch screen interface and display
- Full-color alphanumeric-capable graphical user interface (GUI) •
- 0.1-second resolution for step times (9,999.9 seconds)

Maximum rpm:12000 RPM

- USB/Ethernet port for communications for uploading/downloading process parameters

Vacuum pump

## **Sol Gel Spin Coater Theory**

Sol gel Spin coating has been used to prepare thin films using sol gel method. A small puddle of a sol gel solution onto the center of a substrate is spin coated the on substrate at high speed. Centripetal acceleration causes the formation of a thin film of material on the substrate. The film thickness depends on the solution properties such as viscosity, drying rate, percent solids, surface tension, etc. and RPM and coating time. One of the most important factors in spin coating is repeatability, as subtle variations in the parameters that define a spin-coating process can result in drastic variations in the coated film. A typical spin process consists of a dispense step in which the resin fluid is deposited onto the substrate surface, a high speed spin step to thin the fluid, and a drying step to eliminate excess solvents from the resulting film.

The spin coating methods are static spin coating, dynamic spin coating and multi rpm coating methods.

**Spin coating method** is simply depositing a small puddle of solution on or near the center of the substrate. This can range from 1 to 10 ml depending on the viscosity of the solution and the size of the substrate to be coated. Higher viscosity and or larger substrates typically require a larger puddle to ensure full coverage of the substrate during the high speed spin step.

**Dynamic spin coating method** is the process of dispensing while the substrate is turning at low speed. A speed of about 500 rpm is commonly used during this step of

the process. This serves to spread the fluid over the substrate and can result in less waste of resin material since it is usually not necessary to deposit as much to wet the entire surface of the substrate. This is a particularly advantageous method when the fluid or substrate itself has poor wetting abilities and can eliminate voids that may otherwise form

After the dispense step it is common to accelerate to a relatively high speed to thin the fluid to near its final desired thickness. Typical spin speeds for this step range from 1500-6000 rpm, depending on the properties of the fluid as well as the substrate. This step can take from 10 seconds to several minutes. The combination of spin speed and time selected for this step will generally define the final film thickness. In general, higher spin speeds and longer spin times create thinner films.

**A separate drying step** is sometimes added after the high speed spin step to further dry the film without substantially thinning it. This can be advantageous for thick films since long drying times may be necessary to increase the physical stability of the film before handling. Without the drying step problems can occur during handling, such as pouring off the side of the substrate when removing it from the spin bowl. A moderate spin speed will aid in drying the film without significantly changing the film thickness.

### **Spin Speed**

Spin speed is one of the most important factors in spin coating. The speed (rpm) affects the degree of centrifugal force applied to the resin and the turbulence of the air immediately above it. Relatively minor speed variations at this stage can result in large thickness changes. Film thickness is largely a balance between the force applied to shear the fluid resin towards the edge of the substrate and the drying rate of the resin. As the resin dries, the viscosity increases until the radial force of the spin process can no longer move the resin over the surface. At this point, the film thickness will not decrease significantly with increased spin time. All Cee® spin coating systems are specified to be repeatable to within  $\pm 0.2$  rpm at all speeds.

### **Film too thin**

|  |
|--|
| Spin speed too high Select lower speed |
|--|

Spin time too long Decrease time during high speed step

Inappropriate choice of resin material Contact resin manufacturer

### **Film too thick**

Spin speed too low Select higher speed

Spin time too short Increase time during high speed step

Exhaust volume too high Adjust exhaust lid or house exhaust damper

Inappropriate choice of resin material Contact resin manufacturer